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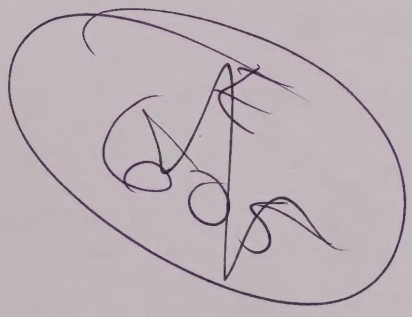
sierra

INSTRUCTION MANUAL

CARRIER FREQUENCY VOLTMETER

KS-15538, L3



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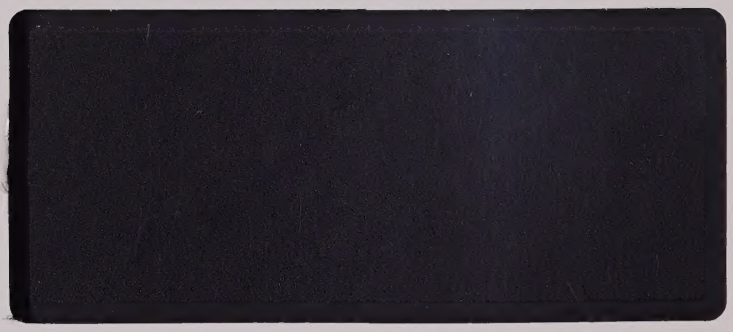

INSTRUCTION MANUAL

CARRIER FREQUENCY VOLTMETER KS-15538, L3

Stock No. 950000092

VIKING LABORATORIES INC.

Warranty

SIERRA ELECTRONIC DIVISION, PHILCO CORPORATION warrants instruments manufactured by it and bearing Sierra commercial model numbers, except Ion Gauge Tubes, to be free from defective material and factory workmanship and agrees to repair such instruments, which under normal use and service, disclose the defect to be the fault of our manufacturing. Our obligation under this warranty is limited to repairing any such instrument which in our sole opinion upon our examination proves to be so defective, when returned to our factory, transportation prepaid by the purchaser, within one year from the date of original purchase from us.

This warranty does not apply to any of our products which have been repaired, worked upon or altered by persons not authorized by us so as, in our sole judgment, to injure the stability or reliability of such instrument, or which have been subject to misuse, negligence or accident, or the serial number of which has been altered, effaced, or removed. Neither does this warranty apply to any of our products which have been connected, installed, used or adjusted otherwise than in accordance with the instructions furnished by us. Nor does SIERRA ELECTRONIC DIVISION, PHILCO CORPORATION assume any liability for consequential damages, and in any event our liability shall in no case exceed the original purchase price of the instrument. Accessories, including but not limited to all vacuum tubes, fuses and batteries, not of our manufacture used with this product are not covered by this warranty.

SIERRA ELECTRONIC DIVISION, PHILCO CORPORATION reserves the right to make changes in the design or construction of any of its instruments at any time without incurring any obligation to make any changes whatever on units previously purchased.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to represent nor assume for us any liability in connection with the sale of our products other than set forth herein.

Manufactured by

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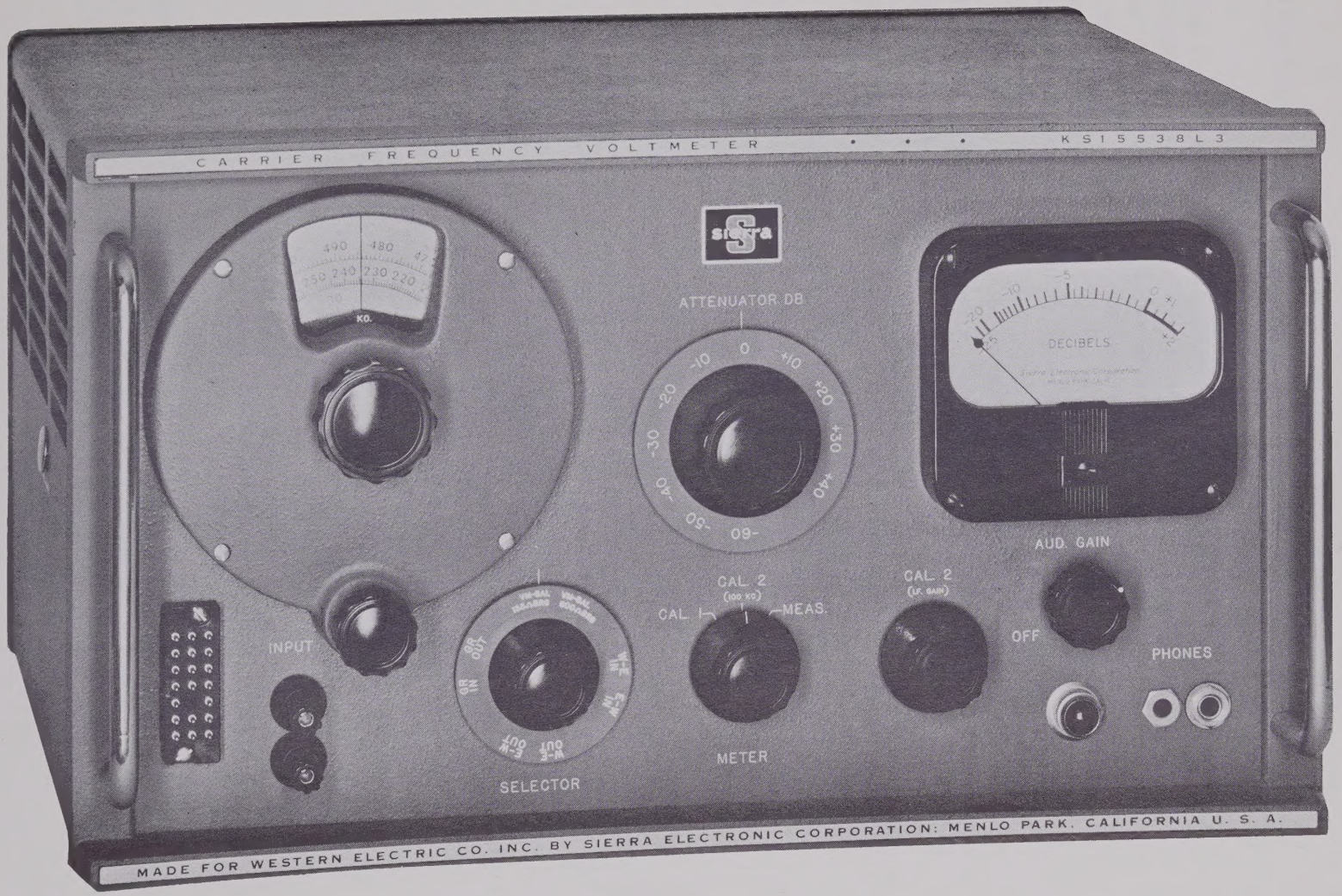
AREA CODE 415 – TELEPHONE 326-2060 TWX 492-9224


CARRIER FREQUENCY VOLTMETER
KS15538L3
ATTENUATOR DB
DECIBELS
AUD. GAIN
CAL. 2
(100 KC)
CAL.
MEAS.
CAL. 2
(I.F. GAIN)
OFF
PHONES
INPUT
SELECTOR
METER
MADE FOR WESTERN ELECTRIC CO. INC. BY SIERRA ELECTRONIC CORPORATION: MENLO PARK, CALIFORNIA U. S. A.

OPERATING AND MAINTENANCE INSTRUCTIONS
For
KS-15538, L3 CARRIER FREQUENCY VOLTMETER

1. GENERAL

The KS-15538, L3 Carrier Frequency Voltmeter is designed to measure voltages in the frequency range of 30 kc to 600 kc. It is a selective detector with a high impedance input and is direct reading in dbm when bridged across either 135-ohm or 600-ohm balanced circuits. A variable attenuator and an indicating meter provide a sensitivity range of -70 dbm to +42 dbm. A jack is provided for monitoring the incoming signal with headphones.

The voltmeter is equipped with an injection oscillator, which is in effect a signal generator, for the purpose of calibrating its sensitivity to input voltages.

2. DESCRIPTION

The front view of the Carrier Frequency Voltmeter is shown in Fig. 1. A block diagram (Fig. 2) is included to help the user understand the functions of the voltmeter. The circuit schematic is shown on drawing E-10492-4, attached.

Input Circuit

The SELECTOR switch provides for the selection of the proper INPUT terminals to be used. The VM BAL 135 ohm BRG position is used for measurements on 135-ohm balanced circuits when connection is made to the INPUT binding posts. The VM BAL 600 ohm BRG position is used for measurements on 600-ohm balanced circuits when connection is made to the INPUT binding posts. All other positions "E-W OUT, W-E OUT, E-W IN, W-E IN, G-R OUT and G-R IN" are for measurements on 135-ohm balanced circuits when connections are made to the INPUT connector. The proper pair of pins for each position is given in the schematic.

The signal input then passes through a section which includes the variable ATTENUATOR and an input filter before reaching the grid of the first converter. The input filter is provided in this voltmeter to suppress undesired signals above the measuring frequency range of the voltmeter. The variable ATTENUATOR reduces accurately the amount of signal arriving at the grid of the first converter in order to increase the voltage measuring range of the instrument. This arrangement also makes possible the measurement of relatively large voltages. The ATTENUATOR steps are in 10 db intervals. The section of the attenuator for steps between 0 dbm and +40 dbm are connected ahead of the filter, those between 0 dbm and -60 dbm follow the filter.

Converter Circuits

The tuning dial on the front of the voltmeter indicates the signal input frequency directly in kc and controls the frequency of a variable frequency oscillator over a range of 1350 kc to 1920 kc. The output of this oscillator combines with the incoming signal in the first converter to produce an intermediate frequency (I.F.) of 1320 kc. The CAL 2 (I.F. GAIN) control is provided for adjusting the gain of the voltmeter. Likewise, the 1320 kc signal, after passing through the I.F. amplifier, combines in the second converter with the 1238 kc crystal-controlled oscillator frequency to produce a second intermediate frequency of 82 kc. The output of the 82 kc amplifier goes directly into the crystal detector, the d-c output of which operates the INDICATING METER.

Indicating Meter

The INDICATING METER has a 0-200 microampere range, but the scale is calibrated in decibels. The calibrations indicate in decibels the ratios of voltages at the input terminals of the voltmeter. The meter is protected for overloads, but large off-scale deflections should be avoided.

Injection Oscillator

An injection oscillator, which operates at 100 kc, is included in the voltmeter. This oscillator provides a fixed amplitude signal which can be switched to the input circuit and substituted for the incoming signal for calibration purposes. When the METER switch is placed in the CAL 1 or CAL 2 position the band pass filter terminals are swtiched from the INPUT switching circuit to the injection oscillator output. At the same time the plate voltage is connected to the injection oscillator.

The injection oscillator circuit contains a vacuum tube voltmeter, for monitoring the amplitude of oscillations to insure an accurate injection signal amplitude. The d-c output from this vacuum tube voltmeter is shown on the INDICATING METER when the METER switch is in the CAL 1 position. This circuit is adjusted for an indication of 0 db when operating properly.

Listening Jack

A PHONES jack is provided on the front panel for the use of a headset, to listen to the incoming signals. The headset is energized from an audio amplifier, the audio level of which is adjustable from the AUD. GAIN control on the front panel. Head sets equipped with either single-plug type connectors or dual-plug type connectors may be used. Single-plug type connectors should be inserted into the right hand jack facing the front panel.

Regulated Voltage

The d-c voltage used in the voltmeter are regulated in the power supply section. The object of this arrangement is to insure relatively constant voltage in the instrument under conditions where the 115V supply is not constant. An adjustment is provided for setting the B Supply voltage at its nominal 225 volt value.

Supply Voltage and Power

This voltmeter is designed to operate from a main supply of 115 volts, 60 cycles. It will operate satisfactorily in the range from 105 volts to 125 volts. The OFF-ON Power Switch is incorporated in the AUD. GAIN control, turn clockwise for ON position. The power drain is approximately 80 volt-amperes.

Dimensions and Weight

The over-all dimensions of the unit are: 14-3/8" deep (over handles) by 17" wide. The height of the unit including rubber feet with the stand retracted is 10-1/16". The height of the unit with stand down is 12". The weight is approximately 34 pounds.

3. PERFORMANCE

Sensitivity

The voltmeter is capable of measuring voltages equivalent to -70 dbm to +42 dbm in either 135-ohm balanced or 600-ohm balanced circuits using the METER scale between - 10 db and +2 db. The accuracy of any ATTENUATOR step from +10 db to -40 db is ±0.3 db at 100 kc. The over-all accuracy of this voltmeter is within the limits given below.

135 Ohm Measurements

30 to 40 kc range:	±2 db for all steps
40 to 548 kc range:	±2 db for +40, -50 and -60 db steps and ±1 db for +30 to -40 db steps
548 to 600 kc range:	±2 db for all steps

600 Ohm Measurements

30 to 600 kc range:	±2 db for +40 to -40 db steps

Additional sensitivity may be obtained by using the METER scale below -10 db. However, these measurements will be less accurate.

Tuning Dial

The tuning dial is adjusted at the factory within ±3 kc in the ambient temperature range of 45° F to 90°F, At 68°F, the calibration is accurate to within ±1 kc over the frequency range of 40 to 548 kc, when properly adjusted by means of the trimmer capacitor C 41at 96 or 100 kc. It is accessible through a hole designated 96 KC ADJUST in the left side of the cabinet (by removing hole plug), and requires the use of an alignment screwdriver, preferably having a recessed blade, to engage the slotted screw within.

Selectivity

The selectivity characteristic of the voltmeter is approximately as follows: 9 db down at 1 kilocycle off resonance, 29 db down at 2 kilocycles off resonance, and 46 db down at 3 kilocycles off resonance. A typical selectivity curve is shown in Fig. 3.

CAL 2 (I.F. GAIN) Control Range

The normal control range of the CAL 2 (I.F. GAIN) adjustment is approximately 16 db and is adjusted at the factory to approximately 8 db above and 8 db below the 0 db mark on the indicating meter.

4. OPERATION

Calibration Using Injection Oscillator

The injection oscillator is adjusted at the factory to give maximum accuracy for calibrating the voltmeter for use on 135-ohm balanced to ground measurements. The calibration obtained will be satisfactory although slightly less accurate for measurements on 600-ohm balanced circuits. If greater accuracy is desired for these measurements, the voltmeter may be calibrated using an external source.

To use the injection oscillator for calibration (after the voltmeter has been turned on for at least 20 minutes):

a. Place the METER switch in the CAL 1 position. The INDICATING METER should show 0 db. If it does not, the oscillator should be adjusted in accordance with the MAINTENANCE section.

b. Operate the METER switch to the CAL 2 position and after setting the ATTENUATOR at 0 db, adjust the tuning dial for maximum response on the INDICATING METER at 100 kc. If the meter reading is not 0 db, it should be so adjusted by the CAL 2 (I.F. GAIN) control knob.

c. The sensitivity is now properly adjusted.

c. Operate the METER switch to the MEASURE position and proceed with measurements.

Calibration Using External Source

If it is desired to use an external source for sensitivity calibration, the following procedure should be followed:

a. Set up a 135-ohm balanced to ground test circuit consisting of an oscillator with a 135-ohm balanced output, a 135-ohm balanced attenuator, and a 135-ohm termination. A 135-ohm thermocouple set is preferred for the termination, but at the expense of some accuracy, a 135-ohm resistance and vacuum tube voltmeter can be used.

b. At a frequency of 100 kc, establish a power of 0 dbm (0.368 volt across the terminating resistance) in the termination.

c. Connect the voltmeter binding posts to the 135 ohm termination. Set the INPUT selector to the VM BAL 135 ohm BRG position and the METER switch to the MEASURE position. Do not make any adjustment of the external circuit after the voltmeter connection is made.

d. With the ATTENUATOR switch in the 0 db position, adjust the tuning dial for a maximum meter reading and adjust the CAL. 2 (I.F. GAIN) control for a 0 db meter reading.

With this adjustment completed, the voltmeter is set at normal sensitivity. For general sensitivity adjustments, the frequency used should be about 100 kc. However, for maximum accuracy, this adjustment should be made in the region of the frequencies under measurement. Always make certain the tuning dial is set for maximum deflection.

If it is desired to calibrate the voltmeter for maximum accuracy for measurements on 600 ohm balanced circuits, the above procedure may be followed using a 600 ohm balanced test circuit with a power of 0 dbm (0.775 volts) and with the INPUT selector in the VM BAL 600 ohm BRG position.

Injection Oscillator Harmonics

The injection voltage is selected from a portion of the Injection Oscillator circuit which is rich in harmonics in order to produce indicating meter deflections when the tuning dial is adjusted to the harmonics of 100 kc or to the 200 kc, 300 kc, 400 kc, 500 kc, and 600 kc settings. This feature is provided for quick check of the tuning dial calibration.

CAUTION: Use only the 100 kc dial setting for injector calibration purposes since the harmonic voltage amplitudes are less than the 100 kc amplitude. A special calibration must be provided if injector calibration at harmonic frequencies is desired.

General Measuring Methods

a. Calibrate the voltmeter as described above using the injection oscillator or an external source as desired.

b. Set the SELECTOR switch to the proper position for the type of measurement to be made and connect the voltmeter to the circuit to be measured. For measurements on 600 ohm balanced circuits, set the switch to the VM BAL 600 ohm BRG position and make connection to the binding posts. For measurements on 135 ohm balanced circuits, set the switch to the VM BAL 135 ohm BRG position and make connection to the binding posts or set the switch to the position corresponding to the measurement desired and make connection to the INPUT connector using the appropriate cord.

c. Adjust the tuning dial for a maximum meter reading at the frequency of the signal under measurement, setting the ATTENUATOR switch as required to obtain the reading.

d. To obtain the magnitude of the signal in dbm, add the reading of the ATTENUATOR algebraically to the meter reading.

Variable Frequency Oscillator Adjustment

When maximum tuning dial calibration accuracy is required, and an accurate 96 (or 100) kc signal source is available, the following procedure should be followed to adjust the frequency of the variable oscillator.

a. Operate the controls in accordance with General Measuring Methods above to receive the 96 (or 100) kc test signal.

b. Then operate the tuning dial to indicate exactly 96 (or 100) kc.

c. Adjust the 96 KC ADJUST control for a maximum reading on the Indicating Meter. This control is accessible through a hole in the left side of the cabinet.

Use of Headset

Headsets equipped with either single-plug type connectors or dual-type connectors may be used for listening to the incoming signals, by plugging into the PHONES jack. Single-plug type connectors should be inserted into the right hand jack facing the front panel. The audio level is adjustable from the control knob labeled AUD. GAIN. Headset resistance should be 2000 ohms or more, because lower resistance sets will not respond as well.

5. MAINTENANCE

General

The Carrier Frequency Voltmeter should require no maintenance during normal use except for occasional change of tubes and removal of dust and dirt. The change of tubes will affect the sensitivity of the instrument and, therefore, it should be rechecked for sensitivity with either the injection oscillator or an external known source of voltage, preferably around 100 kc (see instructions above). If the sensitivity is low, the voltmeter should be lined up as later described. Change of power supply tubes V10, V11, or V12 may require that the potentiometer "V" be readjusted to give a B Supply potential of 225 volts, as measured from pin 8 of tube V10 to chassis ground.

Fuse

A fuse for the main supply is located on the rear of the chassis and is available for replacement by unscrewing the black cap marked FUSE. Replacement fuses should be rated at 2 amperes and be of the 3AG type.

KS-15538,L3

Injection Oscillator

If the tube to be changed is the injection oscillator tube V7, the following steps should be followed after insertion of new tube and allowing at least a 20 minute warm-up period.

a. With the METER switch in the CAL. 1 position, adjust Potentiometer shaft marked CAL. 1 (located close to 5Y3 tube on upper side of chassis) with a screwdriver to give a 0 db reading on INDICATING METER.

b. Operate the METER switch to the CAL. 2 position and adjust frequency of injection oscillator to 100 kc by using screwdriver in slotted shaft marked "H" -- located close to 5Y3 tube on upper side of chassis. Tuning can be accomplished by direct beating of injection oscillator with external frequency source or by tuning the injection oscillator frequency for maximum deflection of INDICATING METER when tuning dial is set to 100 kc. The latter 100 kc tuning dial point should be set from an external source (with METER switch in MEASURE position) to give better frequency accuracy.

c. Adjustments described in paragraphs a. and b. above, enable correct adjustment of the amplitude and frequency of oscillations within the injection oscillator. The usable output level from this oscillator, which is determined by the setting of potentiometer "P" located near the 5Y3 tube on the upper side of the chassis, must also be checked and adjusted if required. First, follow procedure previously described under Calibration Using External Source using the 135 ohm test circuit. Second, place the METER switch in the CAL. 2 position and with the attenuator set at 0 db, adjust the tuning dial for maximum response on the INDICATING METER about 100 kc. If meter reading is not 0 db, it should be so adjusted with a screwdriver in potentiometer shaft marked "P".

Variable Frequency Oscillator

In case it is necessary to change the oscillator tube V8 in the variable frequency oscillator (connected to the tuning dial), it may also be necessary to readjust the circuit constants so that the tuning dial numerals will correspond to the correct incoming signal frequencies. This adjustment is accomplished by connecting the voltmeter to an accurate 600 kc signal source setting the tuning dial at 600 kc and adjusting the oscillator trimmer capacitor C38 for maximum INDICATING METER deflection with a screwdriver inserted in the ceramic slot through the hold designed "O" on the left side of the variable oscillator housing. The 96 KC ADJUST trimmer C41 should be set at about 7 clockwise turns in from its extreme counterclockwise position for this adjustment.

If after the above adjustment has been made and the tuning dial calibration is not within its limits (over the full range of 30 to 600 kc), the following additional procedure should be followed to track the variable oscillator with the tuning dial.

a. Feed an accurate 100 kc signal into the voltmeter, set tuning dial to 100 kc, and adjust the oscillator inductor screw "X" (adjacent to the trimmer capacitor "O") for maximum response on the INDICATING METER.

b. Go back to the 600 kc input signal frequency and tuning dial setting, and readjust capacitor "O".

c. Since there is a slight amount of interaction between the setting of "O" and "X", the above steps should be repeated two or three times more to arrive at the proper final settings for these adjustments.

d. The tuning dial calibration accuracy should now be within its limits over the full range of 30 to 600 kc.

First and Second Converters

In case the first converter tube V1 and/or second converter tube V3 is changed, the adjustment of the C1 and/or C11 neutralizing condensers should be checked. With the voltmeter in the MEASURE condition but with no applied signal, set tuning dial at 250 kc and ATTENUATOR ar "-60" db, and with a low-capacitance R.F. vacuum tube voltmeter (Hewlett-Packard 410A or B) connected from ATTENUATOR rotor lug to chassis ground, adjust C1 for a minimum reading of the V.T.V.M. on its 1 volt range. With the V.T.V.M. probe connected from grid #3 (pin 7) of V3 to chassis ground, adjust C11 for a minimum V.T.V.M. reading in the same manner. If the Hewlett-Packard 410A or B vacuum tube voltmeter is not available, a Hewlett-Packard 400C or 400A type may be used with a 5 mmf capacitor in series with its high side.

Lineup Procedure

In the event it is necessary to electrically realign the voltmeter, the following procedure is suggested.

82 KC I.F. Amplifier: Using a suitable signal generator with low impedance (approx. 5 ohms) unbalanced output, apply .110 volts rms at 82 kc to grid No. 1 (pin 4) on vacuum tube V4 socket and tune the I.F. transformer T5 for maximum response on the INDICATING METER on the voltmeter panel front. This operation should be performed with the METER switch in the MEASURE position.

The tuning of the I.F. transformers will require adjustment at both of the tuning screws extending from the side of the transformer shield. A suitable screwdriver is the only tool necessary for this procedure. When the alignment is complete the INDICATING METER should stand at -1 db ±3 db.

Move the signal generator leads to vacuum tube V3 socket and apply .0032 volts rms at 82 kc between grid No. 3 (pin 7) and ground. Proceed as above and tune transformer T4 for maximum deflection of the INDICATING METER. When this transformer is properly tuned the INDICATING METER should stand at -2 db ±4 db.

Crystal Converter: With the signal generator connected between grid No. 3 (Pin 7) and ground on vacuum tube V3 socket, apply .0032 volts rms at 1320 kc. This procedure will serve to check the operation of this stage as a converter and the INDICATING METER should indicate within 3 db of the reading obtained when 82 kc was applied to this same grid as described above.

1320 kc I.F. Amplifier: Move the signal generator leads to vacuum tube V2 socket and apply 710 microvolts rms at 1320 kc between grid No. 1 (Pin 4) and ground. Maximize the voltmeter output by adjusting the single top tuning screw of Transformer T3. With CAL. 2 (I.F. GAIN) control set for minimum gain (maximum counterclockwise position), the output meter should stand at -3db ±5db.

Move the signal generator leads to vacuum tube V1 socket, and with the ATTENUATOR switch set to the "-40" position, apply 370 microvolts rms at 1320 kc between grid No. 3 (Pin 7) and ground. Proceed as above to tune the I.F. Transformers T1 and T2 for maximum response on the INDICATING METER. The CAL.2 (I.F. GAIN) control should be adjusted for a convenient deflection of the INDICATING METER during this tuning process. Remove the signal generator connection.

First Converter: With the METER switch in the MEASURE position, apply 0.775 volts rms at 100 kc to the INPUT binding posts for this procedure. The ATTENUATOR switch should be set to the 0 db position and the SELECTOR switch should be set to the VM BAL 600 ohm BRG position. Adjust the tuning dial for a maximum meter deflection. With the CAL. 2 (I.F. GAIN) control in its maximum counterclockwise position, the meter reading should be between -10db and -4 db. If the response falls short the 6BA7 vacuum tube at V1 should be exchanged. This tube as received from the manufacturer is subject to wide variations in performance, and it may be necessary to select a tube which will give the required response. If no tube is found to give the required response, it may be necessary to adjust the special coupling condenser C6 by bending the plates slightly (reducing the spacing) to increase the meter reading. If the

meter reading above was too high, the plates of condenser C6 may be bent slightly (increasing the spacing) to decrease the meter reading.

Overall Check: When the above procedure has been completed, the overall sensitivity of the voltmeter should be checked with the use of suitable signal generator and attenuator facilities. For this purpose, all measurements are referred to 0 db deflection on the INDICATING METER at 100 kc on the tuning dial.

6. PARTS LIST

Pages 15 to 19 give the list of component parts used in the voltmeter.

REPLACEABLE PARTS LIST

PARTS REPLACEMENT

Standard components have been used in this instrument whenever possible. Both standard and special components may be ordered direct from the factory.

When ordering parts always include:

1. Sierra Stock Number.
2. Circuit Reference and Commercial Description.
3. Name, Model and Serial Number of the Instrument.

Parts for this instrument, or further service information may be obtained from:

SIERRA ELECTRONIC DIVISION
Philco Corporation
3885 Bohannon Drive
Menlo Park, California 94025

Area Code 415
Telephone 326-2060
TWX 492-9224

Schem. Ref. No.	Description	Sierra Stock No.	Mfgr.	Designation
C1	Capacitor, 1.5-7 mmf 500 Vdcw, Ceramic zero Coef.	32A070	1	TS2A, NPO
C2	Capacitor, 0.1 mf ±20% 200 Vdcw, Paper tubular	10D104	2	330201
C3	Capacitor, 0.1 mf ±20% 400 Vdcw, Paper tubular	10B401	2	330401
C4	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	300411
C5	Capacitor, .0001 mf ±10% 500 Vdcw, Mica	16K101	20	CM19B101
			2	K-1310K
C6	Capacitor, 0.1 mmf - 1.0 mf Adjustable Air		3	SA-5883-2
C7	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C8	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C9	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C10	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C11	Capacitor, 1.5-7 mmf 500 Vdcw, Ceramic, zero Coef.	32A070	1	TS2A, NPO
C12	Capacitor, .0001 mf ±10% 500 Vdcw, Mica	16K101	20	CM19B101
			2	K-1310K
C13	Capacitor, .0001 mf ±10% 500 Vdcw, Mica	16K101	20	CM19B101
			2	K-1310K
C14	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C15	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C16	Capacitor, 0.1 mf ±20% 400 Vdcw, Paper tubular	10B104	2	330401
C17	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C18	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C19	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C20	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C21	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C22	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C23	Capacitor, .001 mf ±10% 500 Vdcw, Mica	16K102	20	CM19B102
			2	K-1210K
C24	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C25	Capacitor, .00025 mf ±10% 500 Vdcw, Mica	16K251	20	CM19B251
			2	K-1325K
C26	Capacitor, .001 mf ±10% 500 Vdcw, Mica	16K102	20	CM19B102
			2	K1210K
C27	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C28	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C29	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C30	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411

Electrical Parts list for Schematic Diagram E-10492-4

KS-15538, L3 CARRIER FREQUENCY VOLTMETER

Schem. Ref. No.	Description	Sierra Stock No.	Mfgr.	Designation
C31	Capacitor, .01 mf ±20% 400 Vdcw, Paper Tubular	10A103	2	330411
C32	Capacitor, 100 mmf ±5% 500 Vdcw, Ceramic tubular	14A101	1	N-750L-101
C33	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C34	Capacitor, .001 mf ±10% 500 Vdcw, Mica	16K102	20	CM19B102
			2	K-1210K
C35	Capacitor, .02 - .02 mf 500 Vdcw, Ceramic disc	14A203	5	5HK-2S2
C36	Capacitor, .001 mf ±10% 500 Vdcw, Mica	16K102	20	CM19B102
			2	K-1210K
C37	Capacitor, 47 mmf ±5% 500 Vdcw	14X470	1	M750K47
C38	Capacitor, 3-12 mmf 500 Vdcw	32X120	1	NS2A-NPO
C39	Capacitor, 52.6 mmf nominal, Air variable	28X530	3	SS-3581-1
C40	Capacitor, 10 mmf ±5% 500 Vdcw, Ceramic tubular	14A100	1	N750A10
C41	Capacitor, .5-5 mmf, Tubular glass piston	30A050	6	VC-5
C42	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C43	Capacitor, .01 mf ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C44	Capacitor, 20-20-20 mf 450 Vdcw, Electrolytic	22B206	2	PLT-4520
C45	Capacitor, .01 ±20% 400 Vdcw, Paper tubular	10A103	2	330411
C46	Capacitor, 0.1 ±20% 400 Vdcw, Paper tubular	10B104	2	330401
C47	Capacitor, 134 mmf ±2% 500 Vdcw, Silver mica	20G1340	20	CM-15E-1340G
C48	Capacitor, 300 mmf ±2% 500 Vdcw, Silver mica	20G301	20	CM-15E-301G
C49	Capacitor, 134 mmf ±2% 500 Vdcw, Silver mica	20G1340	20	CM-15E-1340G
C50	Capacitor, 0.1 mf ±10% 400 Vdcw, Paper tubular	10B104	2	330401
CR1	Germanium Diode 1N34A	105X1N34A	8	1N34A
BP1	Binding Post Assembly	152X3	21	938-WB
BP2	Binding Post Assembly	152X3	21	938-WB
F1	Fuse, 2 amp., Type 3AG	132X1	9	312002
I1	Lamp, 6-8V, 0.15 amp., T3-1/4 bulb	138X1	18	N47
J1	Jack, Phone, Plain	144X3	10	11-JAX
J2	Jack, Phone, Grounding ring	161X1	11	550
J3	Connector Input, 20 Terminals	148X3	12	KS-14160

Electrical Parts List for Schematic Diagram E-10492-4

KS-15538, L3 CARRIER FREQUENCY VOLTMETER

Schem. Ref. No.	Description	Sierra Stock No.	Mfgr.	Designation
L1	Inductor, Fixed 2.5 mh ±3%	90X4	3	SS-4507-1
L2	Inductor, Fixed 150 mh ±3%	90X6	3	SS-4509-1
L3	Inductor, Var. 15 - 25 mh	94X35	3	SS-10858-1
L4	Inductor, Var. 120 - 160 microhenries	94X34	3	SS-10372-1
L5	Inductor, Fixed 360 Max. dc ohm 50 ma.	92X2	3	SS-427-1
L6	Inductor, Fixed 620 microhenries ±3%	90X87	3	SS-9984-1
L7	Inductor, Fixed 620 microhenries ±3%	90X87	3	SS-9984-1
M1	Meter, 200 microamp. 400 ohm dc	118X1	22	SS-4460-1
PL1	Plug #18/3 Type SJ, 10' 6" 3 wire	164X4	12	KS-14532-L1
R1	Resistor, 10K ohm ±10% 1/2 watt	52X103	15	Type EB
R2	Resistor, 100 ohm ±10% 1/2 watt	52X101	15	Type EB
R3	Resistor, 33K ohm ±10% 2 watt	60X333	15	Type HB
R4	Resistor, 10K ohm ±10% 1/2 watt	52X103	15	Type EB
R5	Resistor, 680 ohm ±10% 1/2 watt	52X681	15	Type EB
R6	Potentiometer, 5000 ohm ±10% 2 watt	79X10	3	SS-393-2-10
R7	Resistor, 82K ohm ±10% 1/2 watt	52X823	15	Type EB
R8	Resistor, 100K ohm ±10% 1/2 watt	52X104	15	Type EB
R9	Resistor, 10K ohm ±10% 1/2 watt	52X103	15	Type EB
R10	Resistor, 1 megohm ±10% 1/2 watt	52X105	15	Type EB
R11	Resistor, 56K ohm ±10% 1/2 watt	52X563	15	Type EB
R12	Resistor, 82 ohm ±10% 1/2 watt	52X820	15	Type EB
R13	Resistor, 27K ohm ±5% 1 watt	54X273	15	Type GB
R14	Resistor, 10K ohm ±10% 1/2 watt	52X103	15	Type EB
R15	Resistor, 4700 ohm ±10% 1/2 watt	52X472	15	Type EB
R16	Resistor, 470K ohm ±10% 1/2 watt	52X474	15	Type EB
R17	Resistor, 10K ohm ±10% 1/2 watt	52X103	15	Type EB
R18	Resistor, 220K ohm ±10% 1/2 watt	52X224	15	Type EB
R19	Resistor, 2200 ohm ±10% 1/2 watt	52X222	15	Type EB
R20	Resistor, 10K ohm ±10% 1/2 watt	52X103	15	Type EB
R21	Resistor, 100K ohm ±10% 1/2 watt	52X104	15	Type EB
R22	Resistor, 47K ohm ±5% 1/2 watt	50X473	15	Type EB
R23	Resistor, 150K ohm ±10% 1/2 watt	52X154	15	Type EB

Electrical Parts List for Schematic Diagram E-10492-4

KS-15538, L3 CARRIER FREQUENCY VOLTMETER

Schem. Ref. No.	Description	Sierra Stock No.	Mfgr.	Designation
R24	Potentiometer, 1 megohm ±10% 2 watt	79X11	3	SS-393-2-11
R25	Resistor, 2200 ohm ±10% 1/2 watt	52X222	15	Type EB
R26	Resistor, 100K ohm ±10% 1/2 watt	52X104	15	Type EB
R27	Potentiometer, 250K ohm ±10% 2 watt	79X9	3	SS-393-2-9
R28	Potentiometer, 2500 ohm ±10% 2 watt	79X12	3	SS-393-2-12
R29	Resistor, 1500 ohm ±10% 1/2 watt	52X152	15	Type EB
R30	Resistor, 100K ohm ±10% 1/2 watt	52X104	15	Type EB
R31	Resistor, 79K ohm ±1% 1/2 watt	74X14	16	DC-1/2
R32	Resistor, 1000 ohm ±10% 1/2 watt	52X102	15	Type EB
R33	Resistor, 1 megohm ±10% 1/2 watt	52X105	15	Type EB
R34	Resistor, 1000 ohm ±10% 1/2 watt	52X102	15	Type EB
R35	Resistor, 1000 ohm ±10% 1/2 watt	52X102	15	Type EB
R36	Resistor, 220K ohm ±10% 1/2 watt	52X224	15	Type EB
R37	Resistor, 56K ohm ±10% 1/2 watt	52X563	15	Type EB
R38	Resistor, 25K ohm ±10% 10 watt	64X253	17	FRL-10
R39	Resistor, 1 megohm ±10% 1/2 watt	52X105	15	Type EB
R40	Resistor, 39 ohm ±10% 1/2 watt	52X390	15	Type EB
R41	Resistor, 2200 ohm ±10% 1/2 watt	52X222	15	Type EB
R42	Resistor, 47K ohm ±10% 1/2 watt	52X473	15	Type EB
R43	Potentiometer, 25K ohm ±10% 2 watt	79X34	3	SS-393-2-34
R44	Resistor, 39K ohm ±10% 1 watt	56X393	15	Type GB
R45	Resistor, 108K ohm ±1% 1/2 watt	74X64	16	DC-1/2C
R46	Resistor, 34K ohm ±1% 1/2 watt	74X65	16	DC-1/2C
R47	Resistor, 10.8K ohm ±1% 1/2 watt	74X66	16	DC-1/2C
R48	Resistor, 3400 ohm ±1% 1/2 watt	74X67	16	DC-1/2C
R49	Resistor, 1580 ohm ±1% 1/2 watt	74X68	16	DC-1/2C
R50	Resistor, 1580 ohm ±1% 1/2 watt	74X68	16	DC-1/2C
R51	Resistor, 16 ohm ±1% 1/2 watt	74X69	16	DC-1/2C
R52	Resistor, 35.7 ohm ±1% 1/2 watt	74X70	16	DC-1/2C
R53	Resistor, 124 ohm ±1% 1/2 watt	74X71	16	DC-1/2C
R54	Resistor, 555 ohm ±1% 1/2 watt	74X72	16	DC-1/2C
R55	Resistor, 1130 ohm ±1% 1/2 watt	74X73	16	DC-1/2C
R56	Resistor, 341.9 ohm ±1% 1/2 watt	74X6	16	DC-1/2C
R57	Resistor, 108.1 ohm ±1% 1/2 watt	74X5	16	DC-1/2C
R58	Resistor, 34.19 ohm ±1% 1/2 watt	74X4	16	DC-1/2C

Electrical Parts List for Schematic Diagram E-10492-4

KS -15538, L3 CARRIER FREQUENCY VOLTMETER

Schem. Ref. No.	Description	Sierra Stock No.	Mfgr.	Designation
R59	Resistor, 10.81 ohm ± 1% 1/2 watt	74X3	16	DC-1/2C
R60	Resistor, 3.419 ohm ± 1% 1/2 watt	74X2	16	DC-1/2C
R61	Resistor, 3.162 ohm ± 1% 1/2 watt	74X1	16	DC-1/2C
R62	Resistor, 3.162 ohm ± 1% 1/2 watt	74X1	16	DC-1/2C
R63	Resistor, 2180 ohm ± 1% 1/2 watt	74X74	16	DC-1/2C
R64	Resistor, 598 ohm ± 1% 1/2 watt	74X75	16	DC-1/2C
R65	Resistor, 1960 ohm ± 1% 1/2 watt	74X76	16	DC-1/2C
R66	Resistor, 1580 ohm ± 1% 1/2 watt	74X68	16	DC-1/2C
S1	Switch, Rotary, 4 pole 3 position 2 section	112X13	3	SS-4092-1
S2	Switch, Part of R-24			
S3	Switch, Rotary 3 pole 11 position 3 section	112X1	3	SS-460-1
S4	Switch, Rotary 4 pole 11 position 4 section	112X2	3	SS-1015-1
T1	Transformer, I.F. 1320 kc	98X14	3	SS-10373-1
T2	Transformer, I.F. 1320 kc	98X14	3	SS-10373-1
T3	Transformer, I.F. 1320 kc	98X14	3	SS-10373-1
T4	Transformer, I.F. 82 kc	98X3	3	SS-4510-1
T5	Transformer, I.F. 82 kc	98X3	3	SS-4510-1
T6	Transformer, Plate and Filament 50/60 cps	100X3	3	SS-428-1
T7	Transformer, Line bridging	102X2	3	SA-10491-3
V1	Vacuum tube, 6BA7	107X6BA7		
V2	Vacuum tube, 6SK7	107X6SK7		
V3	Vacuum tube, 6BA7	107X6BA7		
V4	Vacuum tube, 6SJ7	107X6SJ7		
V5	Vacuum tube, 6J5	107X6J5		
V6	Vacuum tube, 6J5	107X6J5		
V7	Vacuum tube, 6SQ7	107X6SQ7		
V8	Vacuum tube, 6SN7-GT	107X6SN7-GT		
V9	Vacuum tube, 5Y3-GT	107X5Y3-GT		
V10	Vacuum tube, 6Y6-G	107X6Y6-G		
V11	Vacuum tube, 6SJ7	107X6SJ7		
V12	Vacuum tube, OB2	107XOB2		
Y1	Crystal, Quartz 1238.0 kc ± .02%	122X8	3	SS-3622-1-4

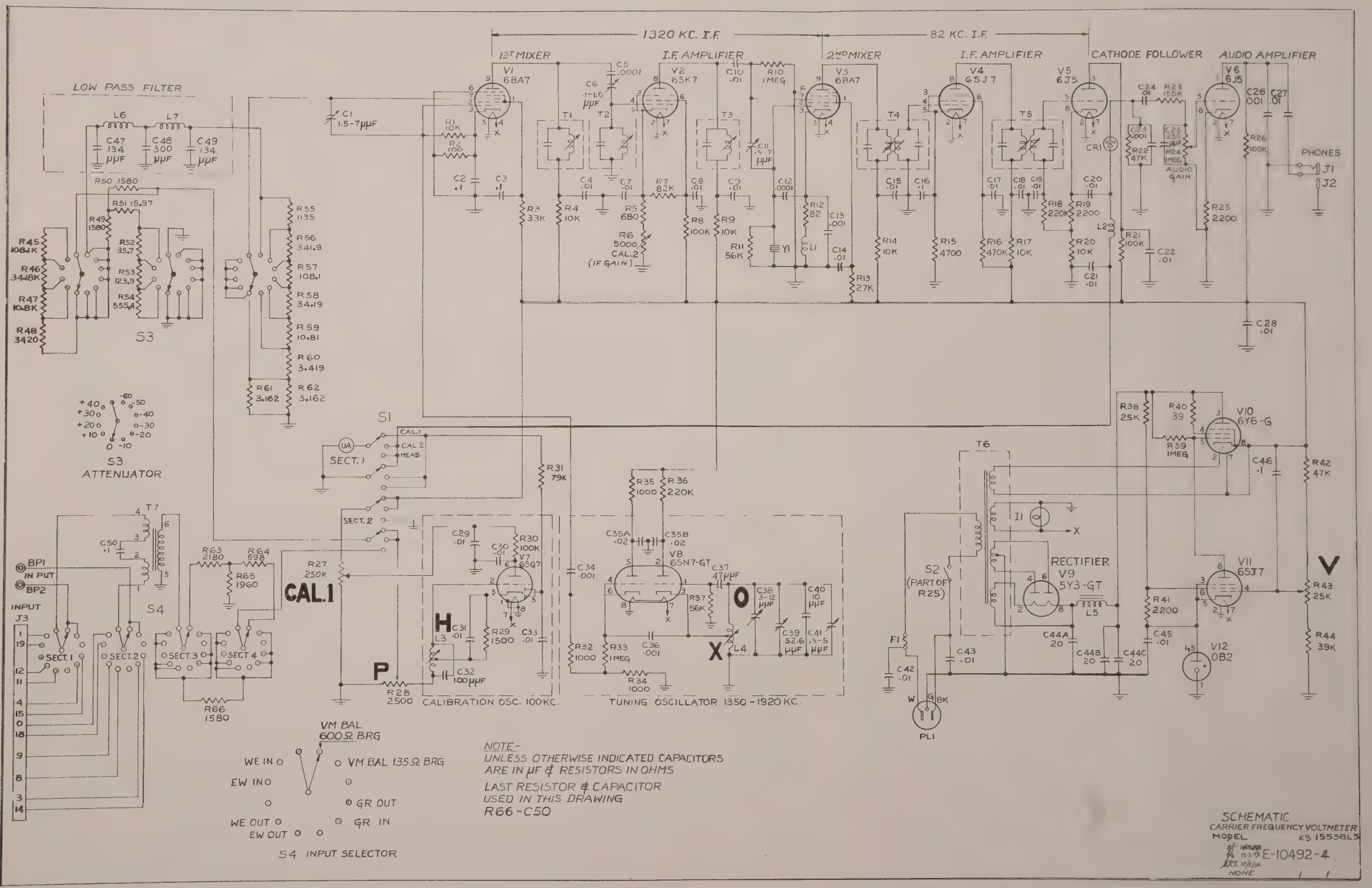
Electrical Parts List for Schematic Diagram E-10492-4

KS-15538, L3 CARRIER FREQUENCY VOLTMETER

Rubber feet 915600001

LIST OF MANUFACTURERS:

Mfgr. Code No.	Manufacturer
1	Erie Resistor Corp.
2	Sangamo Electric Co.
3	Sierra Electronic Corp.
4	Electro-Motive Mfg. Co.
5	Sprague Products Co.
6	JFD Electronics Corp.
7	James Millen Mfg. Co., Inc.
8	Sylvania Electric Products, Inc.
9	Littelfuse, Inc.
10	Switchcraft, Inc.
11	Birnbach Radio Co, Inc.
12	Western Electric Co., Inc.
13	Weston Electrical Instrument Corp.
14	Burlington Co.
15	Allen Bradley Co.
16	Electra Mfg. Co.
17	Model Eng. & Mfg., Inc.
18	Nation Union
19	Hi-Q Aerovox
20	El-Menco
21	General Radio
22	Simpson Electric Co.

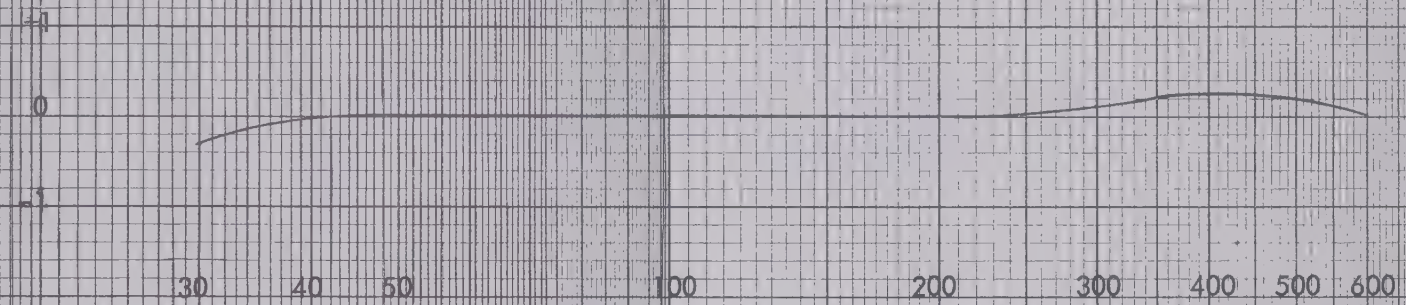


NOTE-
UNLESS OTHERWISE INDICATED CAPACITORS ARE IN μF & RESISTORS IN OHMS

LAST RESISTOR & CAPACITOR USED IN THIS DRAWING
R66-C50

SCHEMATIC
CARRIER FREQUENCY VOLTMETER
MODEL KS 15538L3
E-10492-4
NONE

KS-15538, L3 VOLTMETER
SENSITIVITY VS. FREQUENCY
TYPICAL 135 Ω and 600 Ω



SIERRA ELECTRONIC CORPORATION
10-22-59 SK-12188-1

DO NOT SCALE DRAWING

BLOCK DIAGRAM
CARRIER FREQUENCY VOLTMETER
KS-15538, L 3

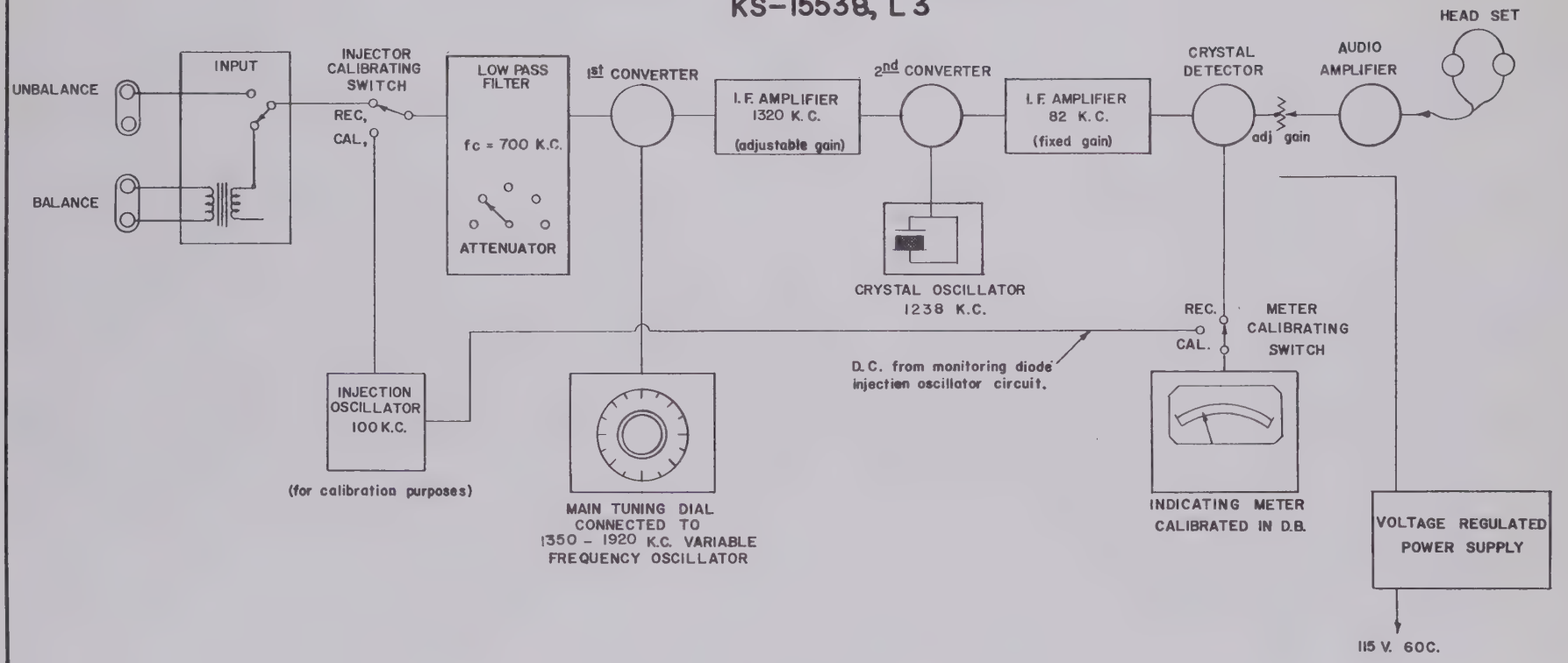


FIG. 2

BLOCK DIAGRAM CARRIER FREQUENCY VOLTMETER	
Sierra Electronic Corporation MENLO PARK, CALIFORNIA	
DATE 4-6-59	E-10909-2

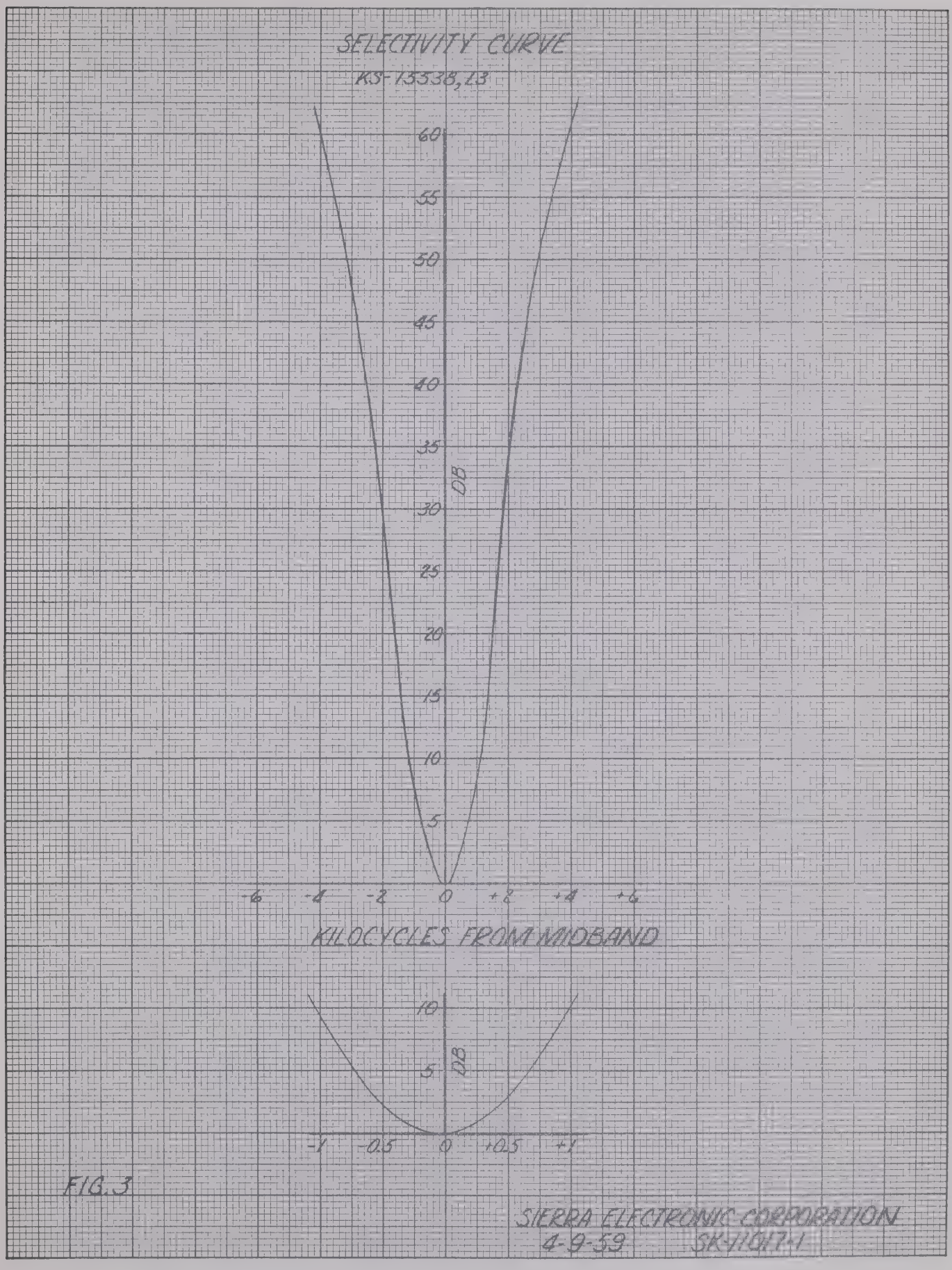


FIG. 3

SIERRA ELECTRONIC CORPORATION
4-9-59 SK-HIGH 7-1